The Vermisphere Concept

Earthworm Activity and Sewage Sludge

Land application significantly increases non-erodable soil aggregates by *Lumbricus* terrestris — and such activities lead to the vermisphere concept.

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VALUES of water stable soil aggregates produced by earthworms have been shown as an indicator of environmental impact related to municipal wastewater application (DINDAL et al. 1979). Our further field and microcosm studies are

oriented to the influence of land application of municipal sewage sludge on earthworm dynamics and production of water stable aggregates (WSA). Forest and meadow soils with known earthworm populations were treated with 5 cm of

aerobically digested sludge and WSA were analyzed 1 yr. after; WSA were also assessed from sludge-earthworm amended microcosms. Distributions of WSA were determined using wet sieving technique of KEMPER and CHEPIL (1965). Data were expressed by vectoral arrays and multivariate descriptions of percent of water stable sample in 6 aggregate size classes, and by mean weight diameter (MWD) parameter of YOUKER and McGUINNESS (1957).

Sludge application treatment increased the percentages of 4 and 2 mm WSA and MWD in both forest and meadow soils. Ordination and trellis representations of field data indicate that the magnitude of changes in WSA distribution is influenced by an active earthworm fauna in direct response to land applied sludge. Population densities in *Lumbricus terrestris* L. (the site dominant earthworm in this study) is positively correlated (r=0.97 [forest] and 0.98 [meadow]) with the percentage of 4 mm WSA.

Microcosms comprised of 4.8 kg silty-clay loam subsoil amended with 7 gm (2 adult) L. terrestris showed a 504 gm increase in 4 and 2 mm WSA over controls after 110 days incubations. Of this increase a maximum of 231 gm (45.8%) is attributable to direct soil casting by worms (maximum casting potential for Lumbricidae equals 30% body weight per day CROSSLEY et al. 1971) while at least 273 gm (54.2% must be caused by alternative consequences of earthworm

VERMISPHERE proposed by W.E. Hamilton and D.L. Dindel DEFINED: SOIL VOLUME CLOSELY ASSOCIATED WITH OPENING AND LONGITUDINAL AXIS OF EARTHWORM BURROW UNDER DIRECT AND/OR INDIRECT INFLUENCE OF THE EARTHWORM. · SYMBIOTIC and other FUNCTIONAL NICHE DYNAMICS of EARTHWORMS that PRODUCE INFLUENCE ZONE .. EARTHWORM MIDDEN SOIL SURFACE MICROHABITAT DE BURROW OPENING. SOIL MICROBIAL STIMULATION by NUTRIENT/ORGANIC LEACHING from MIDDEN COMPLEX. DIRECT INOCULATION of SOIL AGGREGATES (WSA) with ENTERIC MICROBIOTA. DSTIMULATES N.FIXERS SOIL AERATION by FREE GASEOUS (LOQUETetal. 1977) EXCHANGE. and AEROBES. MUCOPOLYSACCHARIDE INCREASE IL COATING ON BURROW SOIL FUNGI (EDWARDS & L 1972). WALLS INCREASE WISA Nand C ENRICHMENT of SOIL by EXUDATES SOIL BACTERIA PRODUCTION of SMALL AGGREGATES by STIMULATED and EXCRETIONS. TRANSLOCATION. COMMINUTION INCREASE INCORPORATION of POROSITY; INCREASED SURFACEAREA and WATER FILMS PROVIDE MICROBIAL MICROHABITAT. SURFACE ORGANIC INHANCE MATTER and MICROBES with ABIOTIC, PHYSICAL STRUCTURE SOIL COMPONENTS. BIOLOGICALLY-CHEMICALLY ACTIVE CONE OF CYLINDER B ALONG BURROWAXIS DUE to EXTENSION of ORGANIC MATTER and SOIL MICRO-BIOTA from BURROW WALL , 25 mm ZOOSPHERE - A GENERAL ZONE of SOIL FORMATION SIMILAR CAUSED by ANIMALS (JOFFE 1936). TERMS DRILLOSPHERE-SPECIFICS CHARACTERISTIC of WALL of BURROWS (LOQUET et al. 1977).

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activity. The "vermisphere effect" (Figure 1) is our summation of these alternative effects of earthworm activity related to such things as symbiosis with soil microbes, natural leaf litterfall, human influences and all abiotic factors of the ecosystem.

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